

Balance Hydrologics

APPROACH AND EMPHASIS

Addressing real world problems with a comprehensive and integrative approach to water resource management, Balance Hydrologics provides in depth expertise in the hydrology of surface and ground-water systems and their complex interactions.

The staff of Balance Hydrologics, Inc. includes senior scientists and engineers who have demonstrated expertise in the fields of:

- Ground-water basin and recharge management
- Conjunctive use of surface and ground waters
- Aquifer storage and recovery
- Managing ground water near sensitive habitat areas
- Safe-yield estimates of water supply aquifers
- Yields and contributing areas of seeps and springs
- Underflow analyses for water rights determinations
- Irrigation percolate and its role in shallow aquifer management
- Development and management of brackish aquifers
- Nonpoint source pollution control
- Migration of nitrates and other nutrients in shallow ground water
- Wellhead protection programs

We emphasize a thorough understanding of the fundamental hydrogeologic processes in a particular area. Rather than rushing into a ground-water model, we will often carefully review historical water level and water quality records in an area, including how they have varied over drought and wet cycles or over a sustained period of water level declines. This type of review can frequently lead to insights which allow us to recommend courses of action specific to our clients' sites and needs. Among these courses of action have been (a) active field studies, such as aquifer testing, tracer tests, or monitoring changes in pumping or water application; (b) passive field studies, such as monitoring of the effects of existing practices, or evaluating ionic or isotopic tracers which occur naturally in various aquifers; (c) geophysical or geologic assessments to better describe the properties or boundaries of an aquifer system; (d) ground-water modeling, using one of several approaches of varying levels of intensity; or (e) preliminary assessments of the feasibility of water treatment (to be designed by others). If models are used, they are calibrated with local field observations, and are usually validated by checking their abilities to predict conditions during previous droughts.

Over the years, we have learned that it is often helpful to approach water or habitat management challenges with an integrated 'conjunctive use' understanding of the local hydrogeologic system. We have also found that development of ground and surface waters seldom occurs in isolation, and calls for considering the concerns of neighboring landholders, or of effects upon nearby communities or environmentally sensitive riparian zones and wetlands. Balance Hydrologics was founded, in large part, to provide clients with the capabilities of responsibly using both ground and surface waters. Our staff consists primarily of senior professionals, each of whom is conversant with both ground water and surface water hydrology and some of the key regulations which guide their management.

Balance Hydrologics is unusual in that all technical staff are relatively senior professionals. This allows us to tailor our work to the specific site and regulatory setting at each stage of a project. Since our experienced staff make the key observations and measurements, work proceeds more quickly, with fewer redundant steps. Results are more credible, because the senior professional presenting the findings at meetings and hearings has been intimately involved with the work. Additionally, the experts on the Balance staff are more available to clients during critical stages, since they are largely free of supervisory responsibilities. When technicians and junior professionals can usefully be assigned to a project, we find that the most knowledgeable individuals are usually available from the client's staff, or from those of their civil engineer, planner, or contractors. This process of 'partnering' strengthens communication within the project team, adding both immediate and long-term value.

The following projects are representative of Balance Hydrologics' staff experience. These projects have been included in this statement of qualifications to illustrate a representative range of the work we have undertaken in areas of recharge management or surface/ground-water interaction, and the related water supply and water quality challenges. A few of these projects were conceived, supervised and directed by our senior staff during prior employment. These projects are marked with an asterisk.

SELECTED PROJECT EXPERIENCE

WATER SUPPLY

City of Watsonville Water Supply Investigation, Watsonville, California

In conjunction with an engineering firm specializing in water distribution and treatment, Balance hydrogeologists assessed various ground-water supply alternatives available in this overdrafted basin subject to sea water intrusion. Older Pleistocene and Pliocene aquifers, largely separate from the presently developed basin were identified. The water supply potential of these possible new sources was assessed through use of geophysical logs from oil exploration boreholes and other seismic data.

City of Ventura, Wells No. 3A and 4A, Ventura County, California *

To support continued growth, the City of Ventura constructed two deep aquifer (Fox Canyon) wells. These wells supplement existing diversions from the Ventura River. The project included geological and engineering support, well design and specifications preparation, construction management, aquifer testing, and water quality analysis. Each 18-inch diameter well had discharge rates in excess of 4,000 gpm.

Aromas/San Juan High School Well, San Juan Bautista, California

Balance staff conducted a hydrogeologic investigation to develop a new ground-water supply for a new high school in the Aromas San Juan Unified School District. Water quality in the San Juan Bautista Basin is locally poor, and well yields can vary considerably. Included in the investigation were: assessment of water quality and water supply issues, geologic services, well design services, and contractor management.

Mt. Diablo Hospital Emergency Backup Well, Concord, California

Mt. Diablo Hospital sought to install a high capacity backup well to provide cooling water, fire flow, and potable water in the event the municipal supply source is disrupted. The hospital engineer specified that the water be suited for only limited treatment, anticipating potential concurrent failure of the facility's water treatment systems.

Working closely with the project engineer, Balance staff utilized well logs, geophysical data, and geotechnical boring to site a well on the hospital grounds,

* Projects marked by an asterisk were performed by another firm with a current Balance staff member serving as project manager or lead investigator while employed by that firm.

supervised the drilling of a pilot hole to a depth of 220 feet, interpreted the geophysical logs and aquifer tests, and assessed the quality of waters in each of the production zones encountered. High sodium waters were found at depth exceeding 175 feet. A design for the well was developed, including specifications for low maintenance, high reliability components appropriate to a backup well.

Monterey Peninsula Water Management District — Sand City Desalination Plant Saline Intake and Brine Disposal, Monterey County, California *

In order to satisfy increased water demands, the MPWMD has proposed the construction of a 3.0 MGD seawater desalination facility that will extract water from coastal dune sands through the use of Ranney collectors. The feasibility of this approach was investigated and the conclusion reached that three Ranney collectors at the site would be capable of producing the required design flow. Also investigated was the use of Ranney collectors to inject brine into the shallow subsurface offshore. The project included drilling, well construction, aquifer testing and solute/flow modeling. It successfully demonstrated that Ranney collectors would be suitable for use and that brine injection was feasible.

Cascade Ranch Water Supply Investigation, Pescadero, California

Balance Hydrologics is serving as the hydrogeologic consultant in developing a lodge and campground in coastal San Mateo County. The Balance staff sited, supervised, and documented drilling of two major exploratory boreholes, up to 740 feet deep, and designed and directed completion of a well meeting the quantity and quality needs for an overnight population of appropriately 500 people. Balance staff specified and performed a development program which included continuous measurement of specific conductance, allowing projection of varying water quality in measured streamflow during development of one well near a coastal stream, so that the extent of stream/aquifer interaction could be quantified.

Shorelands Road and Water Company, Mendocino, California

Balance Hydrologics conducted a hydrogeologic and well siting investigation for a four well mutual water company. Geologic, hydrologic, and water quality criteria were all used to identify three potential well sites meeting the client's criteria of high reliability during late summer and high water quality. A well drilled at the first site produced sufficient water to double available supplies. Balance staff worked with the water company's Board to complete the testing and permitting of the well.

Highland Ranch Water Resources Evaluation, Sonoma County, California

A hydrologic investigation of a 400 acre rural mountain top parcel in Sonoma County evaluated available water resources and existing water quality. The site is located in a setting of variable volcanic rock deposits, portions of which are within a designated active fault zone. Work was completed in conjunction with several

other geology and planning studies to address development alternatives for the site. Tasks included collecting and analyzing water samples for a suite of water quality parameters; identifying possible water well drilling locations; assessing and predicting late summer yields from existing springs, seeps, and an artesian well; reviewing the siting of proposed sub-parcels and septic systems; and evaluating an existing water right.

Hydrologic Assessment of the Gilroy Hot Springs Area, Gilroy, California

Balance Hydrologics conducted a comprehensive hydrologic evaluation of a proposed destination resort at Gilroy Hot Springs, within the rugged Diablo Range of southeastern Santa Clara County. Specific assignments included:

1. Assessing recharge, discharge, and other key elements of the hydrologic budget under varying rainfall conditions
2. Evaluating the water-bearing potential of deeply weathered serpentinitic rocks and fractured consolidated sediments
3. Projecting possible effects of developing local ground water on the discharge or temperature of the hot springs
4. Assessing the quality of water yielded by the hot springs for a range of possible uses, including bathing, bottling, and landscape irrigation.
5. Evaluating nonpoint source discharges to the local streams that feed reservoirs used for public water supply, including assessing various erosion control alternatives

Balance hydrologists designed and directed construction of several successful exploratory wells developed in weathered serpentine that demonstrated sustained yield of good quality. The wells were then compared with other potential water sources in the immediate area to enable the project engineer to design a water-supply system.

Robinson Rancheria Ground-water Supply Investigation, Clear Lake, California

The water quality and potential ground-water yield of wells developed in older alluvium near Clear Lake, California, were assessed for the Robinson Rancheria community. Balance staff worked in close cooperation with local agencies and water treatment engineers to beneficially develop water high in magnesium and carbonate from the alluvial aquifer.

GROUND-WATER BASIN MANAGEMENT

Pajaro Valley Surface and Ground-water Management Study, Monterey County, California

This basin wide study, sponsored by the Association of Monterey Bay Area Governments, encompassed three major elements: recharge protection, recharge augmentation, and development of a management program. Technical tasks emphasized quantifying infiltration through channels, developing a discharge weighted, seasonally variable water quality model of the Pajaro River to assess its suitability for diversion, installing a stream gage at Watsonville, and closely calibrated hydrologic budgeting of 10 sandy watersheds underlain by the Aromas aquifer. Additionally, detailed facies analysis of several formations were undertaken in the coastal portions of the valley to determine most suitable areas for recharge augmentation on the scale of 5,000 to 10,000 acre feet per year.

Salinas River Basin Management Plan — Geohydrologic Study, Monterey County, California*

Monterey County is developing a Basin Management Plan (BMP) to resolve water supply shortfalls in some portions of the Salinas ground-water basin. These shortfalls have resulted in seawater intrusion and localized nitrate contamination. The BMP process is evaluating several water supply projects that will augment the water supply in the basin. In support of the screening process, a study was conducted that consolidated and summarized the hydrogeologic conditions in the study area. The study included analysis of land use, development of hydrogeologic cross sections, locating of more than 400 wells using a GPS system, review of well construction data, evaluation of recharge basin feasibility, and review of water quality and aquifer properties.

Mono Lake Basin Water Management Studies, California

Balance Hydrologics has been conducting a number of field assessments of in-stream and wetland water needs in the Mono Lake watershed as part of the State Water Resources Control Board program to revise water rights in the Mono Basin. Working with botanists and plant ecologists, Balance hydrologists, hydrogeologists and engineers are quantifying surface/ground-water exchange and alluvial aquifer response to changes in flows within streams from which large diversions are made. Results are being used to implement alternative flow regimes optimizing the extent of riparian vegetation and other resource needs. Balance hydrogeologists and sediment quality specialists are evaluating the response of very shallow ground waters sustaining wetlands near the lake and are participating in an interdisciplinary team projecting likely responses of vegetation, wildlife and soil salinity to alternative management levels for the lake.

El Granada Aquifer Yield Assessment, San Mateo County, California

Balance staff, working with a large engineering firm, directed and conducted a detailed hydrogeologic investigation of a 700 acre coastal terrace aquifer system. Ground-water occurrence, aquifer properties, and calibrated water budget calculations for key subareas were analyzed. Basin management strategies tailored to the unique hydrogeologic setting were proposed, and adopted by the Board of Supervisors. The Board also requested that the County's well ordinance be reviewed in light of the findings, and requested that we recommend changes and adaptations appropriate to conditions found in this and other areas of San Mateo County.

Brunei Water Well, Brunei, Southeast Asia*

Ground water in the country of Brunei is an under-utilized resource. Martin Feeney, now Supervising Hydrogeologist with Balance, assisted with developing an alternate water supply to be used during periods when surface supplies are impaired by high turbidity. The 1500-foot well was one this county's first major water wells. Work included direct supervision of the drilling contractor and provision of technical and geologic support for Brunei's technical staff. The well was successfully completed, and further development of the resource is underway.

CONJUNCTIVE USE AND MANAGEMENT OF RECHARGE

Sisquoc River Sediment and Ground-water Study, Santa Barbara County, California

Balance Hydrologics has been charged with developing a comprehensive hydrologic, geomorphic, and hydrogeologic assessment of the Sisquoc Plain area of northern Santa Barbara County, California. The assessment will be used to evaluate alternatives for producing sand and gravel from this designated regionally significant source of PCC-grade aggregates. Balance hydrogeologists have carried out a detailed drilling program to evaluate the resource at depth, and have installed piezometers to measure aquifer response to seasonal recharge. Staff geomorphologists have developed a 61 year daily sediment transport model to estimate mean annual delivery of coarse sediment, year-to-year variability of delivery, and the role of wildfires in delivery of coarse sediment to the Sisquoc Plain. Simulations have been calibrated with measured changes in channel geometry using sequential aerial photographs and other archival information, and with limited sediment transport monitoring. Balance staff are simulating and evaluating use of gravel pits for a program of managed aquifer recharge intended to offset regional ground-water overdraft and to control salinity increases now reaching levels which restrict beneficial uses of the aquifer.

Arroyo Seco Cone Area Investigation, Monterey County, California *

The investigation quantified the interaction between the surface flows of the Arroyo Seco cone area and the underlying ground-water system. Under consideration was the development of spreading basins to allow the use of Arroyo Seco surface water flows for artificial ground-water recharge. The project included: hydrogeologic exploratory drilling/well construction; construction and testing of a pilot recharge basin; and observation of a recharge cycle through one winter season. The investigation concluded that while percolation rates were very high, the proposed project could not cost effectively increase the volume of recharge over natural recharge rates due to the limited availability of ground-water storage and the seasonal duration of flow of the Arroyo Seco.

Seaside Basin Injection/Recovery Study, Monterey County, California

Working in cooperation with an engineering firm, Balance hydrogeologists are developing a conjunctive use program to direct surplus runoff into semi-consolidated sand aquifers in the Seaside area near Fort Ord. The program will use ground-water injection wells. Balance's responsibility involves designing the injection tests, overseeing modifications to the wells to allow effective testing, evaluating the tests to quantify aquifer properties and likely environmental effects, and simulating likely pressures and geochemical responses.

Aquifer Management and Wastewater Re-Use Potential, Ada County, Idaho

Balance Hydrologics staff participated in preparing an Environmental Impact Statement assessing a proposed wastewater management plan for the Boise Valley, Idaho. Their responsibilities in this project included describing existing ground-water hydrology and aquifer characteristics, evaluating the impact of septic tanks and other diffuse sources of pollution on ground-water quality, and analysis of the mitigative effects of alternative wastewater management plans on existing and anticipated conditions. The analysis included quantifying local recharge from unlined irrigation canals and assessing nutrient loadings percolating from nearby agricultural areas. The possible occurrence of naturally occurring nitrogen sources was also evaluated.

Point of Diversion Study, Carmel River, Monterey County, California

Balance Hydrologics hydrogeologists and hydrologists, as part of a larger team, are assessing the feasibility of drawing the Monterey Peninsula's main water supply from a shallow aquifer rather than as a direct diversion from a reservoir. This change would allow existing treatment facilities and pipelines to be utilized while providing important fisheries and riparian habitat benefits as well as sharply reduced treatment costs. Balance's scope includes re-evaluating the geometry of the uppermost Carmel River alluvial aquifer, adapting the existing ground-water model to

incorporate the proposed changes in point diversion, and assisting the local water district in modifying its operational models and in-stream flow simulations.

GROUND-WATER SALINITY AND WATER QUALITY MANAGEMENT

Salinity Management Model, Santa Ynez and Lompoc Valleys, Santa Barbara County, California

Working on behalf of the City of Santa Barbara and four adjoining major water districts, Balance has been developing a water quality model to assess the effects of alternative operations of Lake Cachuma on salinity in alluvial aquifers downstream from the lake. The daily model is based on process (e.g., storm hydrograph separations), substrate (the soils and geology of each subwatershed or distinguishable aquifer) and additions from known point and nonpoint sources. It included contributions of sodium and other dissolved solids upwelling from deep aquifers along fracture zones and through abandoned oil and gas wells. It is calibrated to field records obtained by state and federal agencies during past years when the reservoir and ground-water basins were operated in manners similar to those proposed.

Seawater Intrusion Delineation — 180 foot Aquifer — Salinas Valley Ground-water Basin, Monterey County, California*

Seawater intrusion in the 180 foot aquifer system of the Salinas Valley has advanced inland as far as seven miles. A combination of controlled source audiomagnetotellurics geophysical methods, monitoring well installation and ground-water sampling techniques, was used to delineate the extent of seawater encroachment in this aquifer system. Geophysical data were also combined with well log data to develop an understanding of the nature of the interfingering between fluvial deposits of the Pressure subarea and alluvial fan deposits of the East Side subarea. The project resulted in a significantly improved understanding of the mechanisms controlling the movement of seawater in this aquifer system.

Resort at Squaw Valley, California

The Perini Corporation constructed an 18-hole, links-type golf course at Squaw Valley. The aquifer which underlies the golf course is the sole source of water for the surrounding community. The alluvial sands and gravels beneath and near the golf course are the sole source of water supply for the community of Squaw Valley, a major destination resort. Additionally, state and local agencies maintain a stringent non-degradation policy for both surface and ground-water quality. Kleinfelder engineers and scientists, supported by Balance hydrologists, conducted a seven element site investigation:

1. Comprehensive mapping of soils at the site, including nutrient content and moisture regimes,

2. Constructing a test green and fairway where the actual effects of various fertilizer and herbicide applications on soil, ground water, and storm runoff could be measured,
3. Implementing a water quality monitoring program for the local aquifer, with about 30 wells from which samples can be taken from varying depths,
4. Developing a rigorous chemical management plan based on the results of the previous tasks,
5. Establishing where former uses of portions of the site (stables, sheep camps, wastewater disposal, parking lots, contractor's storage yard) may have affected water quality and characterizing these pre-existing conditions,
6. Designing sediment retention ponds and other erosion control elements to prevent sedimentation of Squaw Creek during construction of the golf course and to protect the course from off-site erosion.

Balance hydrologists presented the results of their studies in papers describing the sedimentology and recharge of Squaw Valley and of a nitrogen budget for the meadow area.

Water Quality Protection Plan for the Santa Lucia Preserve Golf Trail, Carmel Valley, California

Owners of this 18,000 acre preserve are proposing a unique golf trail as the main organized recreational activity in this large natural area. They seek a course which would not harm the quality of water in the adjoining streams and aquifers. Balance led a team, including the project engineers and several specialists, which developed a program meeting the no harm criterion and which rigorously tested several management alternatives by simulating constituent movement and attenuation under severe conditions. Risk analyses were developed for each constituent proposed for application, with human health and index aquatic species tolerances providing the thresholds of significance. The water quality protection program has been accepted essentially as submitted by the County as mitigation for effects of the proposed golf trail.

Nitrate Budget for the San Lorenzo Valley, Santa Cruz County, California

Balance hydrologists and engineers developed a comprehensive nitrate budget for the San Lorenzo Valley. The watershed, primary source of water for a population of roughly 90,000, is home to about 40,000 residents served by approximately 14,000 septic systems. The County's Environmental Health Service conducted a number of investigations addressing concerns over potential taste, odor, and trihalomethane precursors in water diverted from the river. Balance staff quantified the contribution of nitrate-nitrogen from numerous subwatersheds and individual aquifers throughout the watershed and identified nonpoint source control measures appropriate for each of these hydrologic

units. In a later phase of the program, specific control plans were developed and demonstration projects built.

Water Quality Impacts of Parking Lot Runoff on a Sole Source Aquifer, Squaw Valley, California

Runoff from the main parking area for a major ski resort is collected, passed through oil-and-grease separators, and then discharged to shallow ground water through a leach field. The water district that supplies most of the Squaw Valley retained Balance Hydrologics to assess possible effects of this procedure on four nearby water supply wells in shallow sand-and-gravel units within the valley fill. The program developed by Balance staff introduced fluorescent dye into the separators that traced the movement of the leached effluent in the local stream network or into the well field. Effects were estimated for a range of seasonal water levels using field data, finite difference simulations developed by others, and detailed aquifer analysis.

Wellhead and Aquifer Protection Program, McCarthy, Alaska

McCarthy's residents draw water from unusual year round springs and shallow wells in an alluvial aquifer near the snout of the Kennicott Glacier. Visitors to this former mining community in Wrangell St. Elias National Park have increased from 1,000 to 30,000 per year during the past decade. Gradual development of infrastructure and sanitation issues arising from intensive informal camping pose imminent health risks to users of these water sources. Balance Hydrologics has been assisting the McCarthy Area Council with all technical hydrogeologic services in connection with a well head protection program being developed through a grant provided by the State of Alaska and the Environmental Protection Agency (EPA). These include tracing salts injected into the shallow aquifer at several points of interest.

SPECIAL STUDIES: WATER RIGHTS AND AQUIFER CARRYING CAPACITY

Rancho San Carlos Riparian Underflow Management Plan, Monterey County, California

Balance hydrologists and hydrogeologists prepared a plan to protect shallow alluvial water supplies sustaining riparian woodland and aquatic habitat in several small canyons draining from the Rancho San Carlos area south of Carmel. Their detailed mapping of inflows and outflows from these streams during summer months, coupled with analysis of fracture systems and ionic ratios, allowed estimation of which reaches may be affected by proposed water supply pumping from hard rock aquifers at depths of several hundred feet below the alluvial corridors. They confirmed the inferred connections by telemetric monitoring of key stream segments during long duration tests of the target aquifers.

Brush Creek Water Rights Assessment, Mendocino County, California

Brush Creek, near Point Arena, drains a small coastal basin supporting a significant riparian, freshwater aquatic, and estuarine biota. A land owner near the mouth of the stream proposed to irrigate 100 acres of pasture by diverting 200 acre feet annually, primarily from limited summer flows. Balance staff conducted an intensive study of the lower 1.5 miles of the stream on behalf of protestants to the proposed diversion, who draw upon high capacity alluvial wells. The investigation included basic monitoring of stream flow, specific conductance, and water temperatures at six stations on Brush Creek. Water imported into the basin for agricultural use was measured, and the significant relationship between subsurface irrigation return flows and stream discharge was quantified.

San Francisco Theological Seminary Water Rights and Water Supply Program, Marin County, California

Balance assisted the San Francisco Theological Seminary in developing alternatives to protect the yield from bedrock springs on Bald Mountain, which the seminary has used for nearly 100 years for irrigation and backup water supply. Our client was concerned that new bedrock wells proposed by about 20 lot owners on Bald Mountain might deplete the yield of these springs. Historical use was established using aerial photographs showing the extent of irrigated areas, (b) observations and data from archival documents found in various public repositories, and (c) analysis of records developed by the seminary's staff over the years. Working with seminary staff and community planners, three sets of alternatives were developed to minimize effects on the springs, which otherwise would be quite significant.

Montara-Moss Beach Water Well EIR, San Mateo County, California

Balance directed a multidisciplinary investigation of the effects of 59 proposed and 166 potential wells serving residences in the Montara and Moss Beach areas. The master EIR assessed the effects of the proposed program on the amount and quality of water in the dissected marine terrace aquifers underlying the area. Alternatives, including developing community wells and valley scale recharge and extractive programs, were also evaluated.

Well Interference Study, Santa Barbara County, California*

During the assessment of overall ground-water supply in a coastal canyon, issues arose regarding potential interference effects between water users in adjacent canyons. An aquifer testing program was developed to test the sandstone bedrock aquifer system and included the installation of several monitoring wells and the performance of a 14 day aquifer test. Data analysis revealed the existence of a dual porosity system where storage is controlled by primary porosity and transmissivity by secondary porosity.

Image Interpretation for Mojave Water District Water Rights Adjudication, Mojave Desert, California

Landsat space imagery and aerial photography was acquired and analyzed digitally and manually to develop an irrigation history of several different sites. In many cases, evidence had to be developed based on inferences from changes in images taken before and after, but not during, the period of concern. Much of the analysis was corroborated using additional lines of evidence such as power consumption by pumps and testimony. Results were presented to the Division of Water Rights in implementing the recent Mohave River adjudication.

SPECIALIZED STAFF EXPERTISE

Balance Hydrologics offers an expert professional staff, with a broad array of experience in areas throughout the western states and Alaska. Particular staff expertise includes:

Martin Feeney
Senior hydrogeologist

- Aquifer testing and analysis
- Ground-water modeling
- Well design, planning, and coordination
- Recharge management
- Conjunctive use simulations
- Injection well feasibility, planning and permitting

Barry Hecht
Senior hydrogeologist/hydrologist

- Recharge feasibility and management
- Development of fractured and bedrock aquifers
- Shallow ground-water exchange with wetlands and streams
- Underflow analyses, water rights
- Isotope and tracer interpretations

Daniel O. Holmes
Hydrologist/remote imagery specialist

- Consumptive use and crop water demand
- Data base coordination
- Recharge of urban runoff
- Historical water use searches and documentation

Christopher C. White
Water quality specialist

- Soil salinity and drainage
- Agricultural percolate and pesticide mobility
- Effects of septic systems, dairies, and stables on shallow aquifers
- Salt and dye tracer applications
- Nitrogen and phosphorus mobility
- Vadose zone sampling and instrumentation
- Control and recharge of treated effluent

Gary Kittleson
Hydrologist

- Nitrogen and phosphorus management
- Well head protection programs
- Water use by phreatophytic vegetation

Jonathan Owens
Hydrologic Engineer

- Aquifer properties, emphasizing spatial variability of permeability
- Aquifer tests
- Monitoring program design and telemetry
- Vadose zone simulations

The firm also draws upon widely recognized specialists to meet the needs of specific projects.